

CLAIMS

1. A method of evaluating a semiconductor device
5 including a substrate, a dielectric layer, and an SOI layer
formed in this order and further including a local
oxidation of silicon (LOCOS) having a birdbeak portion, by
using an evaluation test element group (TEG), wherein said
evaluation TEG comprises:
 - 10 a first electrode extending in a first direction
and a second direction crossing said first direction;
a second electrode spaced from said first
electrode and extending in said first and second directions,
wherein a first length of said second electrode in said
15 first direction is substantially equal to a first length of
said first electrode in said first direction and a second
length of said second electrode in said second direction is
different from a second length of said first electrode in
said second direction;
 - 20 a third electrode spaced from said first and
second electrodes and extending in said first and second
directions, wherein a first length of said third electrode
in said first direction is substantially equal to said
first length of said first electrode and a second length of
25 said third electrode in said second direction is
substantially equal to a length of said birdbeak portion in
said second direction; and
a plurality of test pads electrically connected
to said first, second, and third electrodes, respectively,
30 wherein said second lengths of said first and second
electrodes are larger than said length of said birdbeak
portion to the extent that said length of said birdbeak
portion can be disregarded, said method comprising:

disposing said TEG on said SOI layer via an oxide film; and

finding a capacitance of said birdbeak portion in a third direction perpendicular to said first and second
5 directions by applying a voltage between said test pads and said substrate.

2. The method according to claim 1, which further comprises the step of evaluating characteristics of a MOS constructing said semiconductor device by calculating,
10 from said capacitance of said birdbeak portion, at least one of a thickness of said oxide film in said birdbeak portion, a thickness of said SOI layer in said birdbeak portion, and an impurity density of said SOI layer in said birdbeak portion.

15 3. The method according to claim 1, wherein said capacitance of said birdbeak portion is found by simplifying a sectional shape of said birdbeak portion in said third direction as a substantially rectangular.

4. The method according to claim 2, wherein said
20 capacitance of said birdbeak portion is found by simplifying a sectional shape of said birdbeak portion in said third direction as a substantially rectangular.

5. The method according to claim 1, wherein said step of finding said capacitance of said birdbeak portion
25 comprises:

measuring capacitances of said first, second, and third electrodes in said third direction by applying a predetermined voltage between said test pads and said substrate;

30 finding a linear relationship between said capacitances of said first and second electrodes and said lengths of said first and second electrodes in said second direction from measured values of said capacitances of said first and second electrodes;

finding a theoretical capacitance of said third electrode in said second direction from said linear relationship; and

subtracting said theoretical capacitance from a
5 measured value of said capacitance of said third electrode.

6. The method according to claim 2, wherein said step of finding said capacitance of said birdbeak portion comprises:

measuring each capacitance of said first, second,
10 and third electrodes in said third direction by applying a predetermined voltage between said test pads and said substrate;

finding a linear relationship between said capacitances of said first and second electrodes and said
15 lengths of said first and second electrodes in said second direction from measured values of said capacitances of said first and second electrodes;

finding a theoretical capacitance of said third electrode in said second direction from said linear
20 relationship; and

subtracting said theoretical capacitance from a measured value of said capacitance of said third electrode.

7. The method according to claim 2, wherein said step of finding said thickness of said oxide film in said
25 birdbeak portion includes finding said capacitance of said birdbeak portion in an accumulation region to find said thickness of said oxide film from said capacitance of said birdbeak portion in said accumulation region and an area of said birdbeak portion, which is defined by said first and
30 second directions.

8. The method according to claim 2, wherein said thickness of said SOI layer in said birdbeak portion is found by subtracting a product of a growth ratio of said oxide film on a silicon side and said thickness of said

oxide film in said birdbeak portion from a thickness of said SOI film.

9. The method according to claim 1, wherein said first, second, and third electrodes are made of a poly-silicon and said method further comprises calculating a degree of each depletion of said electrodes in said birdbeak portion from said capacitance of said birdbeak portion to evaluate characteristics of a MOS constructing said semiconductor device.

10. The method according to claim 9, wherein said step of calculating said degree of said depletion of said electrodes includes:

finding said capacitance of said birdbeak portion in an accumulation region;

calculating a thickness of said oxide film in said birdbeak portion in said accumulation region;

finding a capacitance of said birdbeak portion in an inversion region;

calculating a thickness of said oxide film in said birdbeak portion in said inversion region; and

comparing said thicknesses of said oxide films in said birdbeak portion in said accumulation and inversion regions.

11. The method according to claim 9, wherein said electrodes are made of a poly-silicon and said method further comprises:

finding said capacitance of said birdbeak portion in a weak inversion region (parameter 1);

finding a thickness of said oxide film in said birdbeak portion (parameter 2);

finding a thickness of said SOI layer in said birdbeak portion (parameter 3);

finding a degree of each depletion of said electrodes in said birdbeak portion (parameter 4); and

calculating an impurity density of said SOI layer
in said birdbeak portion by using said parameters 1-4.